TIJUANA ESTUARY

SEDIMENT FATE AND TRANSPORT STUDY

PRELIMINARY DRAFT

SAMPLING AND ANALYSIS PLAN

This preliminary draft SAP has been prepared to facilitate upcoming discussions on November 16, 2007, with federal, state, county, and municipal agencies with regulatory interests related to the proposed project.

Input from this meeting will be incorporated into the SAP and a final Draft will be prepared and formally submitted to the USACE and USEPA for review.

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1.0 INTRODUCTION

This report outlines a Sampling and Analysis Plan (SAP) for the collection and testing of sediment samples from an upland source to determine its suitability in a demonstration project to evaluate dispersal and potential adverse impacts associated with placing materials with a relatively high percentage of fines in the nearshore. Placement is proposed on the beach profile at Border Field State Beach in Imperial Beach, California. The upland site is Goat Canyon Retention Basin, a sediment basin located on a tributary of the Tijuana Estuary. Figure 1 is a site map of the upland project site and also illustrates the area proposed for beach placement.

The goal of the Tijuana Estuary Sediment Fate and Transport Science Study is to study, through an extensive scientific monitoring program and sediment transport model, the movement and impact of fine-grained sediment placed on the beach at this location. This information will be used in the development of a restoration plan for the Tijuana River National Estuarine Research Reserve and will help to facilitate the maintenance of the Goat Canyon Sediment Retention Basin. In addition, the information gained from this study will provide regulators with scientific data related to the impact of placing sediment in the nearshore that contains greater than 20% fine grained particles.

This Draft SAP is being submitted to the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA) for their review and concurrence, prior to any sampling being conducted.

Figure 1. Upland Site Location

2.0 PROJECT DESCRIPTION

There has been extensive wetland loss within the Tijuana Estuary over the past few decades due to sedimentation. This has resulted from large volumes of sediment discharged into the estuary from urbanizing tributaries. To help alleviate this problem, a sediment retention basin was constructed at the mouth of the largest contributing tributary, Goat Canyon, which annually traps greater than 40,000 cubic yards of sediment. Currently, this material is removed by truck to an inland disposal site.

The primary goal of this study is to investigate economical alternatives for removing and disposing the fine-grained sediment from the Goat Canyon Retention Basin. This study investigates the possibility of placing the fine-grained sediment on the beach. If this alternative is a more economical disposal alternative compared to upland disposal with no negative impacts to the environment, then more sediment-choked estuary areas can be restored for the same public investment. However, if this basin is not regularly cleaned, the Tijuana Estuary will continue to fill with sediment, raising the elevation of the marsh and destroying the wetland habitat. Not only is the sediment expensive for the California Department of State Parks to remove and dispose, but it also could be a valuable resource. This sediment could be used to nourish the eroding Border Field State Beach. The dune habitat that separates the Tijuana Estuary from the ocean is rapidly eroding and recent modeling predicts that the dunes will breach by the year 2045 if action is not taken. By placing sediment from the Goat Canyon Retention Basin on the beach, the barrier beach could be enhanced.

The sediment from the Goat Canyon Debris Basin contains a relatively high percentage of fine-grained sediment and would typically be excluded from consideration of beach nourishment. Generally, regulatory agencies limit the percentage of fines to 20% for beach placement (80/20 "Rule of Thumb"). The 80/20 Guideline was originally used as a threshold for determining whether pollutants were attached to the fines in sufficient quantities to be of concern. Subsequently, the 80/20 Guideline has also been applied to the use of clean sediment for beach restoration activities, with long lasting turbidity and burial of nearshore habitat typically stated as the reasons for concern. However, much of California's available nourishment material does not meet the 80/20 Guideline because it contains a higher percentage of fines. Because of this Rule of Thumb, materials that might otherwise be appropriate for beach nourishment and beach restoration projects are typically transported inland to landfills. Existing Opportunistic Beach Fill Programs call for a maximum limit of 25% fines present in beach fill.

The proposed study will consist of three separate placements of sediment on the beach that separates the Tijuana Estuary from the ocean. These placements will be followed by extensive monitoring. The purpose of the study is to determine if placement of along the coast has an impact to the coastal environment for the benefit of further estuary restoration. The findings from the study could also influence future decisions on wetland restoration alternatives, dam restoration options, and available sediment resources that can be used to address coastal erosion issues and regional sediment management.

The proposed upland source site is the Goat Canyon Retention Basin. The total volume of sediment from the basin that will be placed on the beach is approximately 60,000 cy with an expected distribution of approximately 60% sand and 40% fines based on previous sampling of sediments in the Retention Basin. The volume of sediment placed on the beach during each placement project is shown in Table 2, each followed by monitoring. The first placement is proposed for October 2008 and will contain approximately 10,000 cy. The second placement will be in November and will contain 10,000 cy. And the third placement will be in December 2008 and will contain 40,000 cy. Further information regarding the monitoring program is being developed and will be presented in a project description and monitoring plan. The project description will include the characteristics of the material resulting from this proposed SAP, as well as the proposed monitoring efforts.

Table 1. Project Timing and Approximate Volumes

Approx Project Dates	Volume (cubic yards)
October 2008	10,000
November 2008	10,000
December 2008	40,000

3.0 PROJECT TEAM AND RESPONSIBILITIES

The California Department of Parks and Recreation, in cooperation with the California Coastal Conservancy, the Cities of Imperial beach and San Diego, the Tijuana River National Estuarine Research Reserve, and the Southwest Wetlands Interpretive Association are proposing the Fate and Transport Study. The study includes all phases of project implementation including sediment sampling and testing, CEQA compliance, permitting, construction, monitoring, and reporting of results.

The table below outlines the Sampling and Analysis team members and tasks for conducting the sediment sampling work. Tierra Environmental will be the Project Management team. Moffatt & Nichol will develop the sampling plan and coordinate with the agencies. AMEC will conduct the sediment sampling and will complete the CEQA compliance. An analytical laboratory will conduct the grain size and chemistry testing on the sediments.

Comment [a1]: Will update with Lab info when known.

Table 2. Project Team and Responsibilities

Task/Responsibility	Tierra Environmental	Moffatt & Nichol	AMEC	Analytical Laboratory
Overall Project Management	X			
Sampling Plan Development		X		
Agency Coordination		X		
Sampling Site Plan / Positioning		X	X	
Sediment Sampling			X	
Compositing/Sub-sampling			X	
Grain Size Analysis & QA/QC				X
Chemical Analysis & QA/QC				X
Final Report		X	X	

Chris Nordby, Tierra Environmental (858-578-9064)
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Nick Buhbe, AMEC (858-300-4300)

4.0 TIER I INFORMATION

Per the Inland Testing Manual (USEPA and USACE 1998), one of the purposes of Tier I evaluation is to determine what existing information exists and what level of further testing may be required based on the existing data. Tier I is a comprehensive analysis of existing and available information on the proposed project, including all previously collected physical, chemical, and biological monitoring data and testing for both the source material site and the proposed receiver site. Limited sediment characteristic data exist for the Goat Canyon Retention Basin and the receiving beach.

4.1 Site History

Over the past 20 to 30 years, uncontrolled development in the Mexican portion of the watershed has resulted in destabilization of the highly erodible soils of the canyons cut by Goat Canyon creek. This has resulted sediment filling in the historic channels of the creek. Also, land uses at and around the Tijuana Estuary have degraded the condition of the estuary, including agricultural, military activities, and urban development. The south arm of the estuary has been significantly impacted by sedimentation. These disturbances have led to a significant loss of estuarine habitat in this southern portion of the estuary. In 2000, the first phase of the restoration of the southern arm, referred to as the Model Marsh Restoration Project was completed. This project demonstrated the feasibility of a restoration project at this location.

The Goat Canyon Enhancement Project was constructed to protect the existing and future restored estuarine habitats in the Tijuana Estuary system. This project included a system of sediment retention basins to control the sediment influx into the southern arm of the estuary; the Goat Canyon Retention Basin. This basin traps fine-grained sediment as it travels through the watershed towards the southern area of the Tijuana Estuary. Currently, the sediment is collected in the basin, sorted to remove trash and large debris, and loaded onto trucks and transported offsite by Superior Ready Mix.

Currently, a Feasibility Study for the Tijuana Estuary Tidal Restoration Program II is in development (Tierra Environmental 2007). This Feasibility Study outlines the goals, opportunities, and constraints for the restoration of the southern portion of the estuary. One of the Tijuana Estuary restoration goals identified in the Feasibility Study is to use suitable sediments excavated during the estuary restoration project as opportunistic beach fill material to restore the barrier beach and dune system, and demonstrate regional sediment management.

4.2 Previous Sediment Testing

4.2.1 Testing within the Tijuana Estuary

The sediment that underlay the lower Tijuana Estuary area consists of coastal plain sediments of Pliocene to Quaternary age. Unconsolidated Holocene alluvium underlies the valley floor of the Tijuana Estuary and can be characterized as fine-grained sediments deposited by floods, and coarser sediments deposited during episodic floods, and coarse coastal sediments deposited by episodic wash-over of the barrier beach.

A 1999 survey of sediments for the Model Marsh Project used a vibracore to collect sediment samples at 28 locations in the Tijuana Estuary (TEG 1999). Grain size results indicated that the upper deposit of sediment was fine grained sand, and probably too fine for beach nourishment reuse, and the deeper sediments consisted of fine sand and silt (greater than 50% fines). Chemical contamination tests were also conducted these sediments and concluded that the constituents tested were below the ERL (effects range-low) and ERM (effect range-medium) levels, suggesting that the material could be regarded as contaminant-free. Three samples contained low levels of copper, lead, and zinc. Historical agriculture uses in the area may have contributed to the presence of these metals (Tierra Environmental 2007).

Further testing was conducted in 2007 within the lower Tijuana Estuary (Tierra Environmental 2007). Within the areas closest to Goat Canyon Retention Basin (Area 1 and 3), the majority of the samples showed analyte concentrations to be below detection limits. One sample exception (Station 1-2) showed levels of DDTR (48 micrograms per kilogram) exceeding the ERM of 46.1 micrograms per kilogram, but not exceeding the EPA PRGs for residential soils (1,700 micrograms per kilogram). Other samples near the Goat Canyon Retention Basin showed slightly elevated DDT levels (Stations 3-2, 3-3, 3-4) with a concentration of 2.6 micrograms per kilogram, which exceeds the ERL of 1.58 micrograms per kilogram.

4.2.2 Testing within the Goat Canyon Retention Basin

Within the Goat Canyon Retention Basin, previous sediment testing was conducted by AMEC (2007) for grain size analysis. Chemical analysis was not conducted on these sediments. A copy of the AMEC 2007 study is provided in Appendix B.

The AMEC 2007 grain size distribution study tested sediments in four areas of Goat Canyon Retention Basin; the upper basin, lower basin, native stockpile of unsorted material, and a sorted stockpile of processed material. The purpose of the study was to determine if the grain size characteristics were consistent between the four areas and if the material is suitable for use in the sediment fate and transport study. Figure 2 below shows the sampling locations of the AMEC study. The results indicated that the percentage of fines ranged from approximately 27% to 46% and the median grain size (D_{50}) ranged from 0.079 to 0.140 mm. Chemistry and toxicity testing were not conducted as part of this baseline-level study.

ANY OTHER TESTING STUDIES???

Comment [a2]: Possible other sediment testing includes:

Work by Rick Gersberg that was done in Goat Canyon

Cliff may have t some sediment chemistry data

4.3 Potential Sources of Contamination

Sediment that enters the Goat Canyon Retention Basin comes from the upland watershed area, which extends into Mexico. There has been massive clearing of the hillsides and development located within the Goat Canyon watershed immediately south of the U.S/Mexico border (Tierra Environmental 2007). Currently, there has not been much success in controlling this influx of sediment from the source area in Mexico.

Another source of contamination is the potential of untreated sewage crossing the international border via the Tijuana River. The flow of untreated sewage has been noted to emanate from north-trending tributary canyons, including Goat Canyon (Tierra Environmental 2007). In 1999, sewage interceptors were constructed in these north-trending canyons and the construction of the International Wastewater Treatment Plant has reduced the flow of sewage to the estuary and ocean. However, during the winter rainy seasons, untreated sewage may still flow across the international border into Tijuana Estuary and the Pacific Ocean.

Previous sediment testing conducted in 1999 and 2007 indicate that there is a potential for some metals, including copper, lead, and zinc to be elevated due to the historical agricultural uses near the site. Also, previous testing in the Tijuana Estuary has indicated DDTR and DDT levels to be elevated in some areas.

In order for the sediment of the project site to be suitable for beach disposal, the material must satisfy Clean Water Act §230.60(a), which, in part, states that the dredged or fill material will be free from chemical, biological, or other pollutants where it is composed primarily of sand, gravel, or other naturally occurring inert material. The criteria for suitable beach disposal include:

- Physically compatible material meeting Clean Water Act §230.60 criteria: or,
- Physically compatible material with contamination levels equal to or less than beach materials found at the nourishment sites; or,
- Physically compatible material that passes Tier II testing and does not exceed contamination levels acceptable for human exposure.

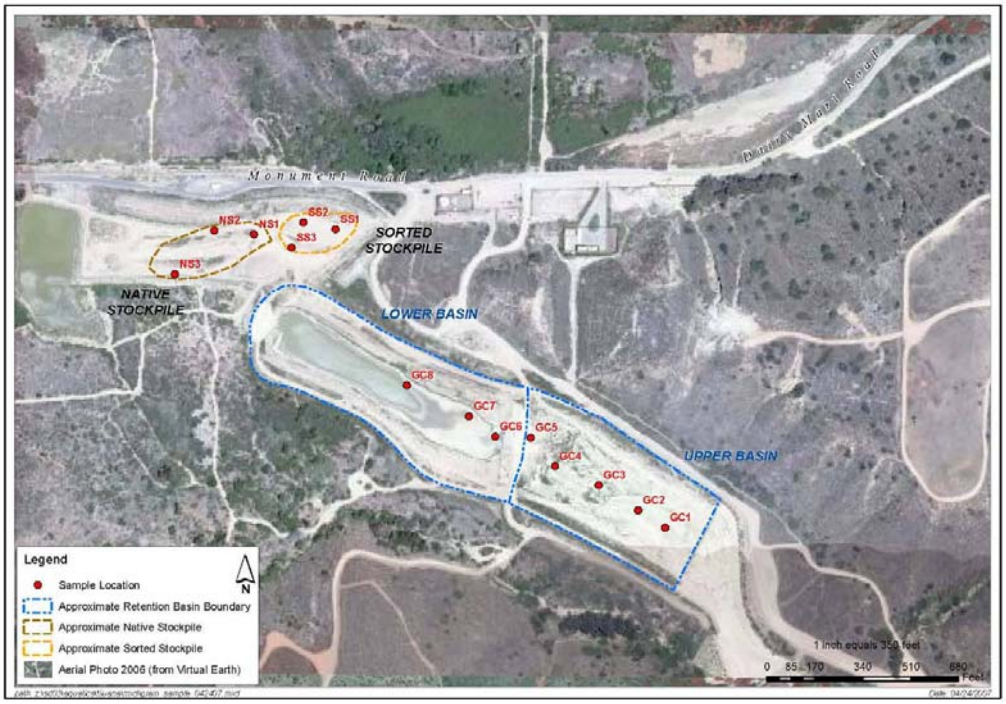

Figure 2. Goat Canyon Previous Sediment Sampling Locations (AMEC 2007)

5.0 SEDIMENT COMPATIBILITY DETERMINATION

The Inland Testing Manual (USEPA and USACE 1998) generally discusses acceptable grain size criteria and effects of turbidity from fines suspended in the water column, but specifics on the acceptable percentage of fines is not specified. The USACE (1989) developed internal guidelines for determining grain size compatibility of source material to receiving beach material. These guidelines served as the basis for the guidelines developed in SCOUP (Moffatt & Nichol 2006). The USACE and USEPA approach for determining the grain size compatibility of potential beach fill material is that the grain size distribution of the source sediment should generally match that within the natural grain size envelope of the receiving beach profile. The USACE and RWQCB incorporated the guidelines from SCOUP into their Regional General Permit 67 (USACE and RWQCB 2006) for considering the compatibility of Less-than-Optimum sands for beach placement. Less-than-Optimum sands are defined as material that is not compatible in grain size with the sand at the dry beach, but is compatible with material within the nearshore portion (between MLLW and closure depth) of the receiver site. The fines fraction of Less-than-Optimum sands should be within 10% of that of the existing nearshore sediments that exist along a profile.

To define the range of sediments on the receiving beach, grain size distribution envelopes the receiving beach will be developed. These envelopes will represent the finest and coarsest gradation curves for the receiving beach. Typically, the finest gradation curves are from the deeper portions of the profile (-12 to -30 feet MLLW) and the coarse gradation curves are from the upper dry beach area above 0.0 feet MLLW.

For this project, the same guidelines as those developed for SCOUP (Moffatt & Nichol 2006) are proposed to determine the level of source material compatibility with the beach placement site. These are:

- A composite gradation curve will be developed for the source material and will be compared with the receiver site grain size distribution envelope. If the source material composite gradation curve generally falls within the limits of the developed grain size distribution envelope of the receiving beach, then the material is determined to be compatible with the native beach material.

- However, one exception is that the source materials should not contain more than 10% of the fines (percentage that passes the No. 200 sieve) at the location of placement at the receiving beach or nearshore zone without more detailed review of the source material. SCOUP (Moffatt & Nichol 2006) recommends that material with high fines content (>20% fines) could be placed either below the Mean High Tide Line or placed within or slightly beyond the surf zone. Placement below the MHTL will allow the fines to gradually winnow out of the material by waves and currents. Surf zone placement places the fine-grained material along the profile where similar sized sand is naturally found.

Bulk chemistry testing will be completed on the source material borings as a screening mechanism for compatibility. If results from the sampling reveal any constituent to be above USACE established screening levels, further chemical testing may be required. Testing will be completed per USACE Inland Testing Manual guidelines.

6.0 SAMPLING AND ANALYSIS REQUIREMENTS

This section outlines the number and location of grain size and chemical testing samples to be taken at the upland source site to conduct a compatibility analysis. At this time, sampling will be conducted on the sediments located in the Native Stockpile only. It is anticipated that all the material in the Sorted Stockpile will have been removed by Superior Ready Mix for their operations. The Upper Retention Basin and Lower Retention Basin have been cleared of material to provide ample retention space for the 2007/2008 wet season.

It is estimated that approximately 40,000 cy of sediment is currently in the Native Stockpile area. The additional 20,000 cy needed for the Study will come from the sediment retention in the Upper and Lower Retention Basins during 2007/2008 rainy season.

The level of future testing that may be required for these additional sediments will need to be discussed with the USACE and USEPA and will be contingent on the results of this SAP. It is, however, assumed that the material would be similar in content to the sediments currently in the basin.

6.1 Source Material Sampling

6.1.1 Number of Grain Size and Chemical Testing Borings

The number of sampling locations at the source site is determined by the following equation per USACE (1989):

$$N = (A)^{1/2}/50$$

Where N is the number of sampling locations and A is the plan area in square yards. Using the equation above and the approximate area, results in two borings. However USACE guidelines state that in no case will less than three representative locations be sampled. Table 3 below shows the area and the calculated number of samples required. It is proposed that at least three samples will be collected from the Native Stockpile area. Samples shall be collected and stored according to USACE and USEPA protocol. The Native Stockpile area is approximately 7,500 square yards in size and approximately 30 feet tall.

Table 3. Sediment Source Areas and Proposed Number of Source Samples for Testing

Source Area	Approx. Area (Sq Yds)	Height of Stockpile (feet)	Number of Borings	Number of Samples Tested for Chemistry	Number of Samples Tested for Gradation
Native Stockpile Site	7,500	30	3	3	3

Grain size and chemistry analyses shall be completed on all of the boring samples identified above.

6.1.2 Location of Borings

The locations of the proposed source site borings are positioned uniformly around the stockpile site and are shown in Figure 3.

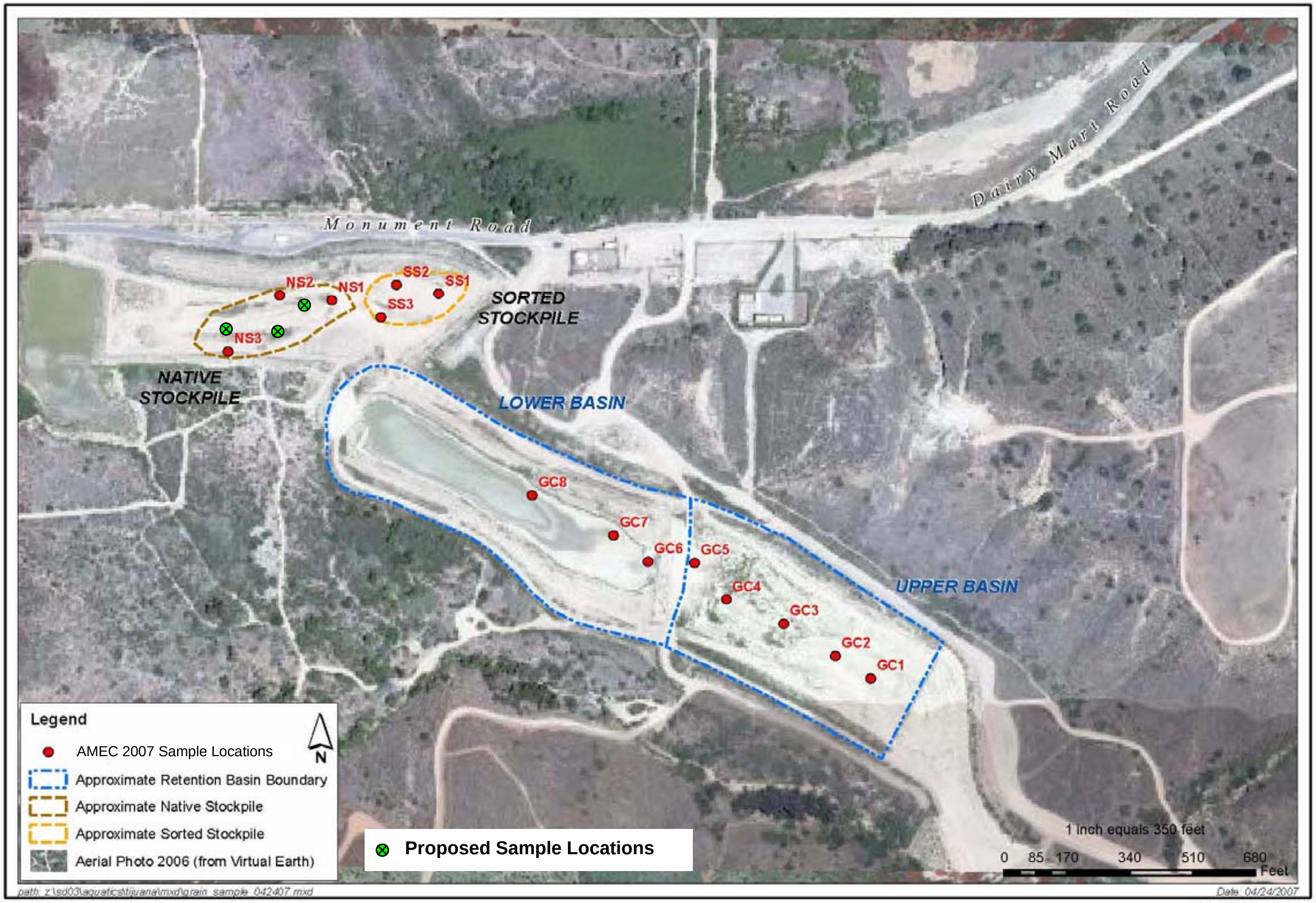

Figure 3. Goat Canyon Sediment Sample Locations

6.2 Receiver Site Sampling

Sediment samples are proposed to be collected at Border Field State Beach to illustrate the existing grain size distribution of the receiver site sediments. Samples will be obtained along two transects approximately perpendicular to the shoreline at elevations of approximately +12, +6, 0, -6, -12, -18, -24, and -30 feet, Mean Lower Low Water as indicated in SCOUP (2006) guidelines. Transect #1 is proposed to be located at the northern limits of the receiving beach and Transect #2 is proposed along the southern limits of the receiving beach. Figure 4 shows the approximate location of the two transects. Per SCOUP, two profiles should be sampled for a receiving beach one mile in length or less. Sampling along these two transects is sufficient to determine the variability of gradation along the reach due to their distance from each other and the shoreline variability at their locations.

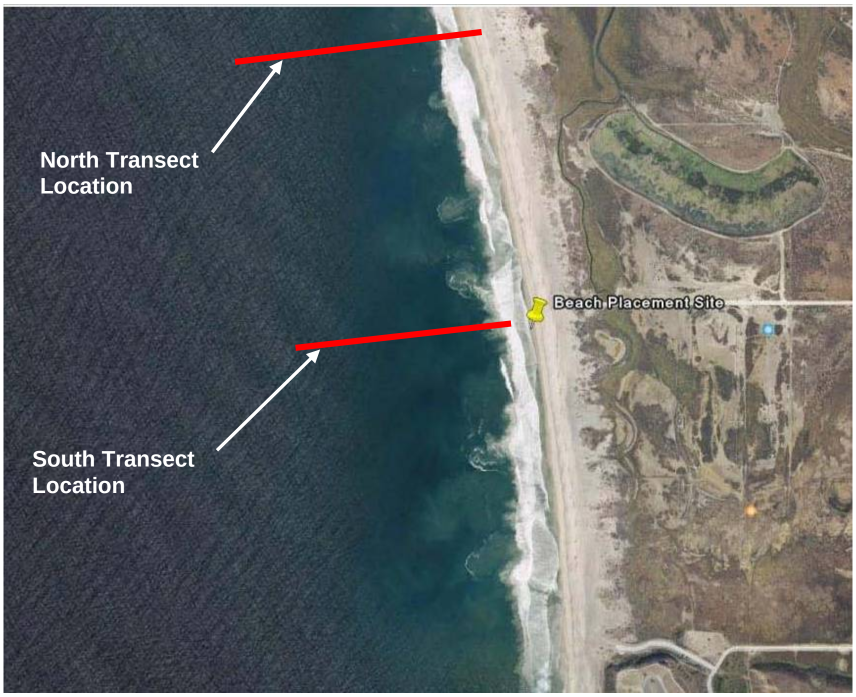

Figure 4. Beach Sediment Sampling Transect Locations

7.0 METHOD OF SAMPLE COLLECTION AND ANALYSIS

Samples will be collected and analyzed in accordance to USACE and USEPA established protocol for the disposal of dredged (excavated) material as outlined in the Inland Testing

Manual (USACE 1998). The Method of Sample Collection and Analysis Section outlines the field and laboratory methodology used in the collection and analysis of grain size and chemical samples.

7.1 Receiver Site Grain Size Testing

Samples will be collected in 100 gram containers and consist of at least the upper 6 inches of sediment depth as recommended in SCOUP. Vertical elevations on the dry beach will be approximated relative to tide elevation at the time of the sampling. A dive gage and fathometer along with predicted tide will be used to estimate bathymetry elevations. GPS coordinates of the dive locations will be recorded. Each container will be labeled with the sample designation. A distinct and descriptive nomenclature will be used on the labels, such as TJN+12, TJN+6, etc. for the north transect and TJS+12, TJS+6, etc. for the south transect.

7.2 Source Material Grain Size Testing

Samples for grain size and chemical analysis from the source site will be collected from an intact boring retrieved from the representative locations within the area to be excavated. Composite gradation curves will be generated from the borings and compared with a receiving beach composite curve to determine compatibility. Samples shall be sieved in accordance with American Society for Testing and Materials (ASTM) D 422-63 (Test Method of Particle-Size Analysis of Soils, ASTM 1999).

7.3 Source Material Chemical Testing

Samples for grain size and chemical analysis from the source site will be collected from an intact boring retrieved from the representative locations within the area to be excavated. Sample locations will be georeferenced and labeled according to depth in relation to MSL. The borings will be collected to depths indicated in Table 3; which reaches the full depth of the stockpile sediment mound. Composite samples will be collected from each of these borings for chemical analysis. Composite samples will be analyzed for metals, non-metals, pesticides, petroleum and volatile organics per USACE Inland Testing Manual (ITM) guidelines. The complete list of analytes and their associated detection limits are listed in Appendix A. This suite of chemicals is presented in SCOUP (2007) based on other recent opportunistic upland source projects intended for beach placement.

7.4 Field Notes

Field notes will be maintained during sampling and compositing operations. Included in the field notes will be the following:

- Name of person(s) collecting and logging the samples.
- General weather conditions and other general observations.
- Date and time of collection.
- Sample station number and sample description.
- Any deviation from the approved sampling plan.

7.5 Compositing Samples

After the cores from the source site have been logged, the boring tubes will be opened. Separate pans will be kept for each individual sample. Appropriate methods and procedures for handling the samples will be adhered to based on the proposed testing of the sediments outlined in Appendix A. Both physical and chemical analysis will be taken from the same homogenate. Portions of each composite sample will be placed in appropriate containers obtained from the laboratory. Each sample container will be labeled with the project name, sample/composite identification, type of analysis to be performed, date and time, and initials of person preparing the sample.

7.6 Sample Transport and Chain-of-Custody Procedures

A chain-of-custody record for each sample will be maintained throughout all sampling activities and will accompany samples and shipment to the laboratory. Information tracked by the chain-of-custody records in the laboratory include sample identification number, date and time of sample receipt, analytical parameters required, location and conditions of storage, date and time of removal from and return to storage, signature of person removing and returning the sample, reason for removing from storage, and final disposition of the sample.

7.7 Holding Times

All samples will be transported to the laboratories within the holding times required for the analytes to be tested. Furthermore, all samples for physical and chemical analysis will be maintained at the testing laboratory and during shipment at the appropriate temperature for the analytes. Additional sediment samples reserved for potential supplementary testing will be stored under chain-of-custody by the analytical laboratory.

Comment [a3]: State Laboratory will be used.

7.8 Quality Assurance / Quality Control

Quality assurance procedures to be used for sediment testing are consistent with methods described in the Green Book (EPA/COE, 1991) and EPA SW-846 (EPA 1986, rev. 1992). For trace analysis, the procedures include documentation of the following criteria for each sample matrix type: analytical reproducibility, analytical detection limits, recovery of in situ metals and organics and sample chain of custody documentation.

The quality assurance objectives for testing are detailed in individual Laboratory QA Manuals, EPA/COE 1991, and EPA SW-846. Objectives for accuracy and precision involve all aspects of the testing process including:

- Methods and SOPs;
- Calibration Methods and Frequency;
- Data Analysis, Validation and Reporting;
- Internal Quality Control;
- Preventive Maintenance; and
- Procedures to Assure Data Accuracy and Completeness.

Sample Storage and Tracking

Sample chain-of-custody sheets; sample receipt logs, sample holding, and sample labeling procedures are detailed in individual laboratory SOPs and are audited periodically by Control staff. Sample storage conditions and holding times are adhered to strictly. Samples are archived throughout the testing period until the final report is accepted.

Chemistry QC Samples

Environmental sample matrix spike and matrix spike duplicate analysis will be performed at a rate of 5%. In the absence of adequate sample quantity to perform matrix spiking for all matrix types, either the imaginary matrix as described in SW-846 or a laboratory solid (e.g., sodium sulfite) will be used for preparing matrix spikes. Matrix spikes are from an environmental sample which is split into three separate aliquots. One aliquot is analyzed free from matrix spike introduction. A known concentration of the analyte of interest is added to the other two aliquots prior to sample preparation and analysis. Both percent recovery and relative percent difference are reported for matrix spikes/matrix spike duplicates. Spike data can provide an indication of matrix bias or interference on analyte recovery. Duplicate data can provide an indication of laboratory precision.

Method or reagent blanks will be analyzed at a frequency of 5% or for every analytical batch, whichever is greater. Analytical batches will consist of 20 or fewer samples, therefore one batch will be created for this project.

Results of all laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the QC criteria specified in the methodology or in this SAP will be identified and the corresponding data appropriately qualified in the final report.

All Quality Assurance/Quality Control records for the various testing programs will be kept on file for review by regulatory agency personnel. It is also anticipated that USACE, RWQCB, and/or USEPA personnel may be present during sampling and may visit the laboratory during testing.

Data Analysis, Validation and Reporting

All physical and chemical tests are performed according to protocols and conditions listed in laboratory SOPs. Raw data and study records are checked to ensure that required test conditions are within specifications cited in the SOPs. Major deviations (e.g. those that could potentially affect test results) from protocol must be approved by both the client and the Quality Control Manager. Unforeseen circumstances that may affect the integrity of the study are reported with the test results. The data, analysis and report are also reviewed for accuracy by the Quality Control Manager.

Report

The field sampling and laboratory analytical report will consist of logs of individual cores, a brief discussion of field and laboratory methods, and a summary of the results of the testing program. For this project, results from statistical analyses will also be reported. These analyses will consist of appropriate F - or t-statistics to compare chemical contamination at the test site sediment and reference site. Statistical significance will be reported at the 95% confidence level (e.g. a=0.05). Any chemical concentrations reported for the test site that are significantly different from the reference site will be compared with recognized guidelines for sediment quality [e.g. NOAA National Status and Trends (Long and Morgan 1990); Florida PELs (MacDonald 1993). Appendices of the laboratory analyses, including final results and quality control and assurance data will be provided. The report will be in a form appropriate for submittal to the Los Angeles District COE, and Region 9 of the EP A for review and approval.

7.9 Supplementary Chemical Testing

The outlined bulk chemistry testing above will be completed as a screening mechanism of the material. If testing results from the sampling reveal any constituent to be above USACE established screening levels, further chemical testing may be triggered. Testing will be completed per USACE Inland Testing Manual guidelines.

8.0 REPORTING

The final report documentation shall contain the following information:

- Introduction –Project description and history.
- Site Maps – Vicinity Map, Plan View, and Cross-sectional Views.
- Core Logs – Logs of fieldwork completed at the source site.
- Methods and Materials - Inventory of all methodology and materials used to implement the proposed SAP.
- Results – Includes results from all chemical and grain-size analysis completed as part of the proposed SAP.
- QA/QC information – Includes all raw data sheets, spike, and recovery information.
- Compatibility Analysis / Discussion – Detailed analysis of chemical and grain-size testing and the compatibility between the source and receiving beach site.
- Field Sheets
- Photographic Documentation
- References

The final document will be completed once all sampling results are obtained and data analysis has been conducted. The completed document will be submitted to:

USACE, San Diego Field Office
16885 West Bernardo Drive, Suite 300 A
San Diego, CA 92127
Attn: Robert Smith

REFERENCES

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Appendix A

Chemical Testing Analytes

Sediment Chemistry Testing

Such-and-Such Laboratory will conduct all analytical chemical analyses and will analyze the samples in accordance with EPA and USACE-approved methods for the constituents listed in the table below. This suite of tests was presented in SCOUP (2006) and is a focused list of potential analytes applied to other recent opportunistic beach fill projects using upland derived source sediment. Total solids/water content will also be determined and reported to 0.1 percent solids. The sediment chemistry tests shall consist of the following parameters at the detection limits shown. All data shall be reported in dry weight unless otherwise specified.

Comment [a4]: We will need to contact the laboratory that we choose to use and update the STDLs.

Table 1. Chemical Analyses for Sediment Samples

Parameter	Method	Procedure	Sediment Target Detection Limit (dry weight)
Physical / Conventional Tests			
Grain Size	Plumb (1981)	Sieve/Pipette	1.0%
Percent Solids	SM 2540G	Gravimetric	0.1%
Percent Volatile Solids	Plumb (1981)	Gravimetric	0.1%
Specific Gravity	Plumb (1981)	Gravimetric	0.001 g/cc
TOC	Lloyd Kahn or equiv.	Combustion IR	0.1%
Total Sulfides	Plumb (1981)	Titrametric	0.1 mg/kg
Dissolved Sulfides	SM 45000 S2D	Titrametric	0.1 mg/kg
Oil and Grease	USEPA 413.2	Gravimetric	100 mg/kg
TRPH	USEPA 418.1	IR Spectroscopy	20.0 mg/kg
Metals			
Arsenic (As)	USEPA 6020	ICP-MS	0.1 mg/kg
Cadmium (Cd)	USEPA 6020	ICP-MS	0.1 mg/kg
Chromium (Cr)	USEPA 6020	ICP-MS	0.1 mg/kg
Copper (Cu)	USEPA 6020	ICP-MS	0.1 mg/kg
Lead (Pb)	USEPA 6020	ICP-MS	0.1 mg/kg
Mercury (Hg)	USEPA 7471	GFAAS	0.02 mg/kg
Nickel (Ni)	USEPA 6020	ICP-MS	0.1 mg/kg
Selenium (Se)	USEPA 6020	ICP-MS	0.1 mg/kg
Silver (Ag)	USEPA 6020	ICP-MS	0.1 mg/kg
Zinc (Zn)	USEPA 6020	ICP-MS	1.0 mg/kg
Pesticides			
4-4′ DDD	USEPA 8081	GC/ECD	2 µg/kg
4-4′-DDE	USEPA 8081	GC/ECD	2 µg/kg
4-4′-DDT	USEPA 8081	GC/ECD	2 µg/kg
Aldrin	USEPA 8081	GC/ECD	2 µg/kg
α-BHC	USEPA 8081	GC/ECD	2 µg/kg
β-BHC	USEPA 8081	GC/ECD	2 µg/kg
Chlordane	USEPA 8081	GC/ECD	10 µg/kg
δ-BHC	USEPA 8081	GC/ECD	2 µg/kg
Dieldrin	USEPA 8081	GC/ECD	2 µg/kg
Endosulfan I	USEPA 8081	GC/ECD	2 µg/kg

Parameter	Method	Procedure	Sediment Target Detection Limit (dry weight)
Endosulfan II	USEPA 8081	GC/ECD	2 µg/kg
Endosulfan Sulfate	USEPA 8081	GC/ECD	2 µg/kg
Endrin	USEPA 8081	GC/ECD	2 µg/kg
Endrin Aldehyde	USEPA 8081	GC/ECD	2 µg/kg
Heptachlor	USEPA 8081	GC/ECD	2 µg/kg
Endrin Ketone	USEPA 8081	GC/ECD	2 µg/kg
Heptachlor Epoxide	USEPA 8081	GC/ECD	2 µg/kg
γ-BHC	USEPA 8081	GC/ECD	2 µg/kg
Methoxychlor	USEPA 8081	GC/ECD	4 µg/kg
Toxaphene	USEPA 8081	GC/ECD	20 µg/kg
PCBs			
Aroclor 1016	USEPA 8082	GC/ECD	10 µg/kg
Aroclor 1221	USEPA 8082	GC/ECD	10 µg/kg
Aroclor 1232	USEPA 8082	GC/ECD	10 µg/kg
Aroclor 1242	USEPA 8082	GC/ECD	10 µg/kg
Aroclor 1248	USEPA 8082	GC/ECD	10 µg/kg
Aroclor 1254	USEPA 8082	GC/ECD	10 µg/kg
Aroclor 1260	USEPA 8082	GC/ECD	10 µg/kg
Dioxin/furan Screening			
Dioxin/furan	USEPA 4425	Detection of total TEQ	20 ng/kg TEQ
Dioxin/furan Confirmation			
2,3,7,8-TCDD	USEPA 8290	GC/MS	1.0 ng/kg
1,2,3,7,8-PeCDD	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,6,7,8-HxCDD	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,7,8,9-HxCDD	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,4,6,7,8,9-HpCDD	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,4,6,7,8,9-OCDD	USEPA 8290	GC/MS	5.0 ng/kg
2,3,7,8-TCDF	USEPA 8290	GC/MS	1.0 ng/kg
1,2,3,7,8-PeCDF	USEPA 8290	GC/MS	2.5 ng/kg
2,3,4,7,8-PeCDF	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,6,7,8-HxCDF	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,7,8,9-HxCDF	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,4,7,8-HxCDF	USEPA 8290	GC/MS	2.5 ng/kg
2,3,4,6,7,8- HxCDF	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,4,7,8-HxCDF	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,4,6,7,8-HpCDF	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,4,7,8,9-HpCDF	USEPA 8290	GC/MS	2.5 ng/kg
1,2,3,4,6,7,8,9-OCDF	USEPA 8290	GC/MS	5.0 ng/kg
Semivolatile Organics			
2,4-dimethylphenol	USEPA 8270M	GC/MS SIM	20 µg/kg
2,4,6-trichlorophenol	USEPA 8270M	GC/MS SIM	20 µg/kg
2-chlorophenol	USEPA 8270M	GC/MS SIM	20 µg/kg
2,4-dichlorophenol	USEPA 8270M	GC/MS SIM	20 µg/kg

Parameter	Method	Procedure	Sediment Target Detection Limit (dry weight)
2-nitrophenol	USEPA 8270M	GC/MS SIM	20 µg/kg
4-nitrophenol	USEPA 8270M	GC/MS SIM	20 µg/kg
4-methylphenol	USEPA 8270M	GC/MS SIM	20 µg/kg
4,6-dinitro-2-methylphenol	USEPA 8270M	GC/MS SIM	20 µg/kg
2,4-dinitrophenol	USEPA 8270M	GC/MS SIM	20 µg/kg
Pentachlorophenol	USEPA 8270M	GC/MS SIM	20 µg/kg
Naphthalene	USEPA 8270M	GC/MS SIM	10 µg/kg
Acenaphthylene	USEPA 8270M	GC/MS SIM	10 µg/kg
Acenaphthene	USEPA 8270M	GC/MS SIM	10 µg/kg
Fluorene	USEPA 8270M	GC/MS SIM	10 µg/kg
Phenanthrene	USEPA 8270M	GC/MS SIM	10 µg/kg
Anthracene	USEPA 8270M	GC/MS SIM	10 µg/kg
Fluoranthene	USEPA 8270M	GC/MS SIM	10 µg/kg
Pyrene	USEPA 8270M	GC/MS SIM	10 µg/kg
Chrysene	USEPA 8270M	GC/MS SIM	10 µg/kg
Benzo(a)anthracene	USEPA 8270M	GC/MS SIM	10 µg/kg
Benzo(b)fluoranthene	USEPA 8270M	GC/MS SIM	10 µg/kg
Benzo(a)pyrene	USEPA 8270M	GC/MS SIM	10 µg/kg
Indeno(1,2,3-cd)pyrene	USEPA 8270M	GC/MS SIM	10 µg/kg
Dibenzo(a,h)anthracene	USEPA 8270M	GC/MS SIM	10 µg/kg
Benzo(g,h,i)perylene	USEPA 8270M	GC/MS SIM	10 µg/kg
Organotins			
Monobutyltin	Rice et al. (1987)	GC/FPD	1 µg/kg
Dibutyltin	Rice et al. (1987)	GC/FPD	1 µg/kg
Tributyltin	Rice et al. (1987)	GC/FPD	1 µg/kg

%	percent
ng/kg	nanogram per kilogram
µg/kg	microgram per kilogram
g/cc	gram per cubic centimeter
n/a	not applicable
GC/ECD	gas chromatography with electron capture detection
GC/FPD	gas chromatography/flame photometric detector
GC/MS	gas chromatography/mass spectrometry
GFAAS	graphite furnace atomic absorption spectrophotometry
SIM	selected ion monitoring
TEQ	toxicity equivalent

Appendix B

Final Report
Goat Canyon Retention Basin
Soil Particle Size Distribution Study
(AMEC 2007)